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The Economic Survey for 1948

The target set by the Government for the production of iron castings for this year is 3,000,000 tons, which is 300,000 tons less than the output we suggested. Actually, during the last quarter of 1947, the industry was producing at the rate of 3,239,804 tons per annum, so that to reach our target the rate would need increasing by 60,616 tons. This is well within the capacity of the industry if the nature of the requirements does not change too radically. This we fear, and whilst there is ample capacity for the mass production of the lighter castings, it is difficult to get reasonable delivery for castings weighing more than a ton. Obviously, any increased output depends upon the supply of pig-iron, scrap and coke. Pig-iron production is promising, coal is better, coke variable, whilst scrap is the subject of intensive examination by a Government Commission. The future trend of the production can be gauged from the increased or reduced demands as set out in the White Paper, so that the individual foundry can—if it be so designed and equipped—"switch" some production. We have for several months been concerned about the market for builders' castings. Already, in some sections, merchants are finding difficulty in moving their stocks. We have a good deal of sympathy with this section of the foundry industry. It was nearly shut down during the war. Then it was exhorted to mechanise and produce. It staged a brilliant recovery, only to be told now to "hold back." The export of builders' castings is not easy because the market is limited, with but little entry into the "dollar" area.

One of the most puzzling features of the White Paper is the complete failure by the Government to place entrants to industry just where, in the Government's view, they are most needed. Thus, of the increase of 330,000 in civilian employment, most joined the ranks of the less essential trades. Typical examples were increases of 178,000 instead of 55,000 in distribution and consumers' services and 14,000 in public services, instead of a decrease of 80,000. Of noteworthy decreases, there were 9,000 instead of 39,000 in agriculture and fishing; 28,000 instead of 40,000 in coal mining, and 61,000 instead of 70,000 in textiles. Germane to this failure is the expectancy of a 450,000 unemployment level during this year. It is stated that this figure will embrace in the main those who are but temporarily out of work. Does this mean that a real attempt—say by direction—is to be made to staff the undermanned industries? Amongst these, according to the White Paper, is the manufacture of iron castings. Our information is perhaps a little more detailed. The shortages are skilled men, women and boys; for the rest the industry can manage.

Like ourselves, the Federation of British Industries, the Association of British Chambers of Commerce and the National Union of Manufacturers are not exactly enamoured of a system of restricting prices and profits and of centrally controlling wages. The proposed stabilisations are being asked for before the effect of the recent advances in the costs of coal, transport and raw materials have been fully felt. For manufacturers of castings, it is an almost daily experience to receive notices from suppliers that because they in their turn are being similarly treated, they must raise prices.

However, these great organisations have promised to use their undoubted authority to increase production, to do all possible to reduce prices where conditions permit, or at least to place a ceiling on existing ones, and to limit dividends, but they do look to the Government on its side to say exactly what is demanded from private enterprise. We believe suitable action by the Government—perhaps something on the lines of Belgian policy—would be the greatest possible contribution to the economic stability of this country.

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Latest Foundry Statistics

The Bulletin of the British Iron and Steel Federation reports that the output of steel for steel castings in January was 7,900 tons, as against 7,100 in December and 6,800 tons in January, 1947. Pig-iron production in February was running at a yearly average rate of 9,169,000 tons, as compared with only 6,560,000 in February, 1945. Steel also showed a remarkable advance from an average rate of 10,726,000 in February, 1947, to 15,049,000 last month.

A survey issued by the Ministry of Supply last week shows that, in the year from January 4, 1947, to January 10, 1948, the labour force employed in the ironfoundry industry has increased from 127,062 to 138,168, and that output has gone up from 709,498 tons in the last quarter of 1946 to 809,846 tons in the same period last year. Individual output has increased from 5.58 to 5.86 tons. The total production in 1947 was 2,846,385 tons.

Up to the end of 1946 a part of the industry was working a 47-hour week, whereas from the beginning of this year a 44-hour week was in operation. The figures show, therefore, a higher output per man-hour.

Aga Heat Limited

Last Tuesday, at the Dorchester Hotel, Aga Heat, Limited, entertained their distributors to a dinner and cabaret. Mr. V. Jobson, the chairman of the company, presided. He was supported by Mr. W. T. Wren, the managing director, Mr. H. C. W. Bennetts, a director of Allied Ironfounders, Limited, and leading personalities from the builders' merchants. In moving amongst the guests, it was learnt that stocks of rainwater goods were particularly scarce, which flatly contradicts what is printed in this week's editorial. The gossip at this function is probably the more correct, and what is usually a reliable source of information has in this case somehow or other slipped up. The speeches from both hosts and guests were well delivered and witty, and emphasised in no uncertain manner the close co-operation afforded to the distributors by undoubtedly enterprising and enlightened suppliers. The cabaret which followed was of a particularly high order.

Retirement of Mr. George Bidgood

Last Friday at the Lyceum Theatre, the staff of the FOUNDRY TRADE JOURNAL and its associated publications were the guests of the proprietors at a cocktail party organised in honour of Mr. George Bidgood, who is retiring after 47 years in the advertising department. Tributes to his long and efficient services were paid by Mr. Barrington Hooper, C.B.E., and Mr. Sydney Walton, C.B.E. On behalf of the proprietors, Mr. Bidgood was presented with a radio set by Mrs. E. G. Weston, the secretary of the company. Mr. Bidgood, in expressing his gratitude for the reception accorded to him, recalled that when he first became associated with publishing, wood cuts were still used for illustrating the advertisements.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

MARCH 22.

The Junior Institution of Engineers.

Sheffield and District Section :—

"Light Alloys and Some Engineering Applications," by H. A. Wainwright, at the Metallurgical Club, West Street, Sheffield, at 7.30 p.m.

MARCH 23.

Institute of British Foundrymen.

Slough Section :—

Annual General Meeting followed by the showing of the Film "Atomic Physics," at 7.30 p.m., at the Lecture Theatre, High Duty Alloys, Limited, Trading Estate, Slough.

Institute of Welding

Sheffield and District Branch :—

"Welded Repair of Mill Machinery," by A. E. Preston, and "Bronze Welding of Cast Iron," by R. Ryalls, at 6.30 p.m. for 7.0 p.m., at the Royal Victoria Station Hotel, Sheffield.

MARCH 24.

Institute of British Foundrymen.

Birmingham and West Midlands Branch :—

"Making Special Duty Castings in Aluminium Alloys," by J. Caven and H. W. Keeble, at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7.15 p.m.

Sheffield Metallurgical Association.

"Some Techniques and Results in Metallurgical Research," by Dr. N. P. Allen, at 198, West Street, Sheffield, at 7.0 p.m.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

MALLEABLE IRON

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—The Paper by Joly* on Malleable Iron, contains statements which call for comment.

Palmer has shown that the manganese-sulphur ratio determines the type of graphite formed during the annealing of malleable iron. Excess sulphur results in the nodular type being precipitated, while excess manganese or balanced manganese and sulphur causes aggregates of graphite to be produced. Curiously, the nodular form is confined to normal whiteheart malleable iron, the annealing temperature for which invariably exceeds 1,000 deg. C. It is quite common practice today for malleable irons to be produced, whose microstructure consists of aggregates of graphite in a matrix of ferrite, by soaking at 1,000 to 1,050 deg. C. in a decarburising atmosphere and slowly cooling through the lower critical range. The irons thus produced have properties of ductility and free machinability equal to the highest grade blackheart malleable irons and tensile strengths in excess of 20 tons per sq. in. It is without doubt that, in some cases, the initial soaking period could be considerably reduced, with little, if any, deterioration in physical properties. As a matter of interest, the amount of steel scrap used to produce the initial white irons is very small, and in some cases nil.—Yours, etc.,

E. C. BROUGH.

H. W. Lindop & Sons, Limited,
Walsall.

*Printed in the JOURNAL, February 26, 1948.

The Radiographic Inspection of Jet-engine Aluminium Alloy Castings

By W. A. Mader, Chief Metallurgist, Oberdorfer Foundries, Inc., U.S.A.

A considerable part of the General Electric TG 180 jet engine powering the Republic "Thunderjet" and other similar fast planes consists of high-quality aluminium castings. The Oberdorfer Foundries, Inc., Syracuse, N.Y., has been the major producer of these castings for the General Electric jet engines through various sub-contractors in the Army Air Forces since the inception of this type of engine in the United States. At the time of writing this article these castings are being made for Allison Div., General Motors Corp., Indianapolis, Inc., and Thompson Products, Inc., Cleveland, Ohio.

Alloy Compositions

The castings are made of two different aluminium alloys. The two alloys have the following chemical compositions:—

	General Electric Alloy B12G21J* (Al 356T6)	General Electric Alloy B12G5A.
Silicon	6.5 to 7.5 per cent.	—
Magnesium	0.2 to 0.4	—
Tin	—	7.50 to 11.00 per cent.
Nickel	—	2.00 to 4.00
Copper	0.20 max.	—
Manganese	0.10 max.	—
Iron	1.00 max.	—
Zinc	0.05 max.	—
Titanium	0.20 max.	—
Other impurities	0.05 max., each	—
Aluminium	Balance	85.00 to 91.00

Castings made from B12G21J alloy are solution-treated and aged for maximum strength and used in the highly stressed housings. Castings made from B12G5A are used in oil seals, etc., where good bearing qualities are required. These castings undergo a stress-relief heat-treatment.

The B12G21J castings are very complex aluminium castings, and although this alloy is readily castable, the complexity of the castings and the very stringent quality requirements entailed major problems in developing the procedure required to make satisfactory castings. The B12G5A alloy is far more difficult to cast, as it is subject to segregation and feeding problems because of the tin and nickel content. However, the B12G5A castings are of relatively simple design and, once the proper gating and feeding methods were found, little trouble was experienced in producing these castings.

Fig. 1 is a photograph showing these various types of aluminium-alloy castings, both in the as-cast and the machined conditions. These castings vary in weight from about 1 lb. to approximately 350 lbs. in the ready-to-ship condition.

X-ray Equipment and Testing

Oberdorfer Foundries, Inc., has X-ray laboratory facilities for the inspection of both bronze and aluminium alloy castings. These facilities include a General Electric X-ray Corp. OX 250 machine (250,000 volts; 15 M.A.), dark room equipment, film filing space, film viewers, and the necessary technically trained personnel to operate the laboratory. This X-ray equipment is normally used in the development of casting procedures by X-raying sample castings made under trial procedures. After satisfactory trial castings have been obtained, percentage checks are made on the production runs. X-ray inspection is also used to check the quality of weld repairs on castings.

Fig. 2 shows the viewing, checking, and filing facilities of the Oberdorfer Foundries laboratories. Checking, tabulation, reporting of the X-ray inspection results, and filing of the films are considered more important than the X-ray inspection of the castings only, as unless all this information is readily available, there is little use to X-ray castings.

Trial castings were first made in the case of these aluminium alloy jet engine castings. After it was considered that the trial castings were satisfactory, both from the results of X-ray examination and the customer's approval, production runs were made and the first twenty-five castings on each pattern were X-ray inspected. If all these castings passed X-ray inspection requirements, a percentage check was made on all future production runs. If any corrections were necessary, or engineering changes altering casting characteristics were made, the above procedure was repeated. This procedure greatly facilitated development of the proper casting technique, and resulted in low foundry and machine-shop losses.

Limited Welding Permitted

The General Electric Corporation specified for each casting, by blue-print, the method of making weld repairs on the B12G21J castings, and these blue-prints were followed by the Army Air Force and sub-contractor inspection departments. All major welds were required to be checked by X-ray examination. The representative films showing the quality of the weld repair were forwarded to the customer, properly identified and accompanied by an affidavit listing pertinent information. X-ray procedure was conducted according to Army-Navy Aeronautical Specification AN-I-26. This, among other requirements, requests that the films show better than 2 per cent. sensitivity using the pierced strip type pene-

* Since the writing of the article, the B12G21J alloy has been replaced by AMS4214B, which has the following percentage composition: Si, 4.5 to 5.5; Cu, 1.0 to 1.5; Mg, 0.4 to 0.6; Cr + Ti, 0.08 to 0.30; Fe, 0.60 max.; Mn, 0.30 max.; Zn, 0.3 max.; other impurities, each 0.05 max. and total 0.15 max., and Al the remainder.

Radiographic Inspection

trometer. A very satisfactory repairing procedure was developed and permitted the use of slightly imperfect castings, with no reduction of service life, after the welding of small defects.

In the case of the stator casting shown being X-rayed in Fig. 3, the customer, Thompson Products, Inc., felt that the machining costs and stringent inspection standards warranted 100 per cent. X-ray inspection. Therefore, each casting was X-rayed to check for internal foundry defects in all areas of the casting. Two of these stator castings are bolted together before machining to form a cylinder, then the castings are bored, removing about ¼ in. of metal from the internal circumference of each casting, and dove-tail slots are machined circumferentially in the internal surface. These dove-tail slots hold aluminium rings in which the compressor blades are inserted. Tolerances are such that, if one of the pair of stator castings in an assembly must be rejected due to a foundry defect uncovered during machining, the mating casting must also be scrapped. These castings are relatively uniform in cross-sectional area and castings of this character are subject to centre-line shrinkage. This type of major shrinkage appears in the centre of the casting and seldom breaks through the surface, and thus is not generally uncovered during the machining of the dove-tail slots. Small air bubbles may be trapped in the metal and appear in the flanges and bosses. No evidence of these bubbles generally appears on the surface of the casting.

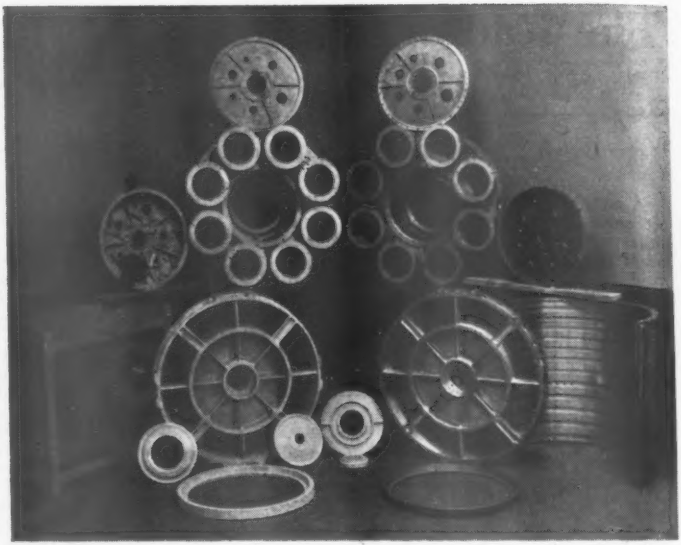

FIG. 1.—GROUPS OF JET ENGINE ALUMINIUM CASTINGS.
LEFT—AS-CAST; RIGHT—AS-MACHINED.

A total of 16 X-ray films (6 — 14 in. × 17 in. and 10 — 4½ in. × 17 in. films) were used to cover all the areas on each casting. Eastman type A X-ray film was used for both welds and the 100 per cent. inspection, this type film having been found to give the necessary sensitivity with good speed when using the correct technique. Approximately 2,000 stator castings have been X-rayed to date.

FIG. 2.—CHECKING X-OGRAPHS OF ALUMINIUM ALLOY CASTINGS. NOTE THE FACILITIES FOR VIEWING AND FILING.

The General Electric Company repair blue-print for the stator casting does not allow welding on the inside of the casting and not more than five welds per casting are permitted. No single weld repair could be more than 2 in. in diameter.

Establishment of Standards

Standards for X-ray inspection of the stator castings were set up through consultation between the laboratories of the Oberdorfer Foundries and Thompson Products laboratories, who correlated machine-shop losses due to foundry defects with X-ographs of castings. Oberdorfer Foundries laboratories

examined the X-ographs of the castings before they were shipped, rejecting castings that they felt did not meet X-ray standards, or assigning them to be welded as permitted by the General Electric weld repair drawing. All X-ographs on castings to be shipped were forwarded to Thompson Products laboratories, who also checked the X-ographs before the castings were allowed to enter the machine shops.

One hundred per cent. X-ray inspection of the stator castings reduced machine-shop losses due to foundry

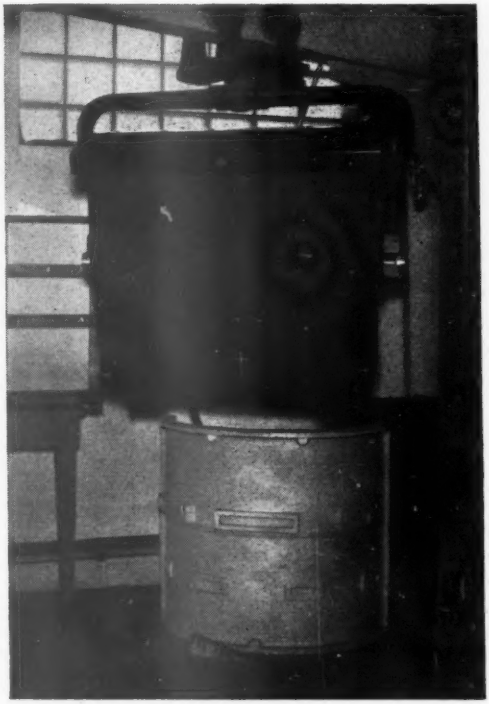

FIG. 3.—X-RAY INSPECTION OF AN ALUMINIUM ALLOY STATOR CASTING.

defects to below 0.5 per cent. and reduced the total foundry scrap, including X-ray rejections, to below 5 per cent. These low scrap losses for this type casting were effected in the foundry through alterations in the foundry technique made possible through close co-operation of the Oberdorfer Foundry and Engineering personnel with the laboratories. Further reductions in scrap losses on this casting are still considered possible with better pattern and moulding equipment.

Value of X-ray Inspection

X-ray inspection contributed greatly to the maintenance of similar high quality standards and low scrap losses in the balance of these aluminium alloy jet engine castings, even though these components are considered difficult to cast and the quality standards very severe.

X-ray inspection of castings reached its greatest peak during World War II, because of the great demand for high-quality castings, particularly in the aircraft engine field. Jet engines, because of their greater power and more severe service conditions, require the maintenance of at least the same high quality as, or even higher quality than, standards set up during World War II. X-ray inspection and its proper application in the foundry industry will assist in obtaining and maintaining these necessary high-quality standards.

The same methods of X-ray inspection used on aluminium alloy jet engine castings as applied to development of foundry technique, maintenance of quality standards on production, and inspection of weld repairs, have been applied at Oberdorfer Foundries to other castings of a critical nature cast from both aluminium and copper-base alloys, with equally satisfactory results both to the casting buyer and the producing foundry. Companies buying castings should consider these applications of X-ray inspection and make use of this valuable tool in foundries so equipped in order to reduce machining losses, which are not only costly due to the loss of the value of the machined casting, but also cause far more costly delays in production. While X-ray inspected castings demand premium prices to defray the cost of X-raying and the higher standard of quality required, the results, as shown by its application to the castings described in this article, justify their greater use.

A Foundry Jubilee

We extend to Broom & Wade, Limited, of High Wycombe, our warmest congratulations on attaining the fiftieth anniversary of their establishment in 1898. Especially is it good to recall that throughout the whole of this period the founder, Mr. H. S. Broom, the chairman and managing director, was in control. Known all over the world to manufacture highly efficient air compressors, the works has shown continuous growth, until to-day it occupies a 12-acre site. It possesses a well-equipped mechanised foundry for producing the numerous castings which go into the make-up of the modern compressor. The January-February issue of the "Broomwade News Bulletin" is devoted to describing this worthwhile story of individual enterprise.

Sir Graham Cunningham's New Appointment

Sir Graham Cunningham, whose appointment as chairman of the committee to inquire into scrap and pig-iron supplies has been announced in the House of Commons by the Minister of Supply (Mr. G. R. Strauss), is chairman and managing director of the Triplex Safety Glass Company, Limited. He is also chairman of the Alliance Property Company, Limited. During the war Sir Graham, who is 55, was chief executive and controller-general of munitions production at the Ministry of Supply. He was knighted, and later awarded a K.B.E., for his war services.

D

A Comparison of X-Ray and Gamma-Ray Methods for Testing Steel Castings

The following statement, by the Steel Castings Division of the British Iron and Steel Research Association, in which a comparison is made of X-ray and Gamma-ray testing methods, has been prepared as a guide to prospective users of radiographic equipment. It is compiled from information supplied by the Non-destructive Testing Sub-Committee and from other sources.

Relative Cost of Plant

The size of X-ray unit required is governed by the maximum thickness of metal to be examined, and equipment for examining thick sections is considerably more costly than that for examining thin sections, as will be seen from Table I. The initial cost of a radium source is somewhat smaller, and it is possible that there will be a reduction in its price before long. As to other sources of Gamma-rays which offer some technical advantages over radium, radon is at present only available in a limited quantity through Government Departments, but Thorium, Limited, are planning a laboratory and equipment to meet the needs of all radon users in the country, and it is anticipated that it will come into operation in the near future. Radiothorium is in use, and whilst its cost is high (£10 per millicurie), this might be reduced if an extensive bank of mesothorium were laid down for extraction, the procedure being similar to that of radon extraction from radium. Artificial radio elements will probably be produced within the next few years, but it has yet to be shown that they offer any substantial advantage over radon for industrial radiography.

TABLE I.—*Relative Costs of Equipment.*

Thickness of steel to be examined.	Type of equipment.	Approx. capital cost.*
1 in.	X-ray, 150 Kv.	£1,400
3 in.	,, 250 Kv.	£2,000
4½ in.	,, 400 Kv.	£4,000
6 in.	,, 1,000 Kv.	£15,000
8 in.	Gamma-ray, 200 mgms. radium	£1,300
10 in.	Gamma-ray, approx. 600 millicurie radon	£30 per seed half-life, 3.8 days
10 in.	Gamma-ray, approx. 400 millicurie radiothorium	£4,000 half-life, 1.9 years

* Exclusive of the cost of construction of suitably protected laboratories to house the apparatus and the cost of ancillary gear, such as cassettes, films, dark-room equipment, etc.

In the case of Gamma-ray units, a special laboratory for conducting the examination is not essential, but a laboratory or floor space adequate to supply protection by distance is necessary.

Mobility.

In general, X-ray plants are not transportable, and consequently castings must be brought for examination to the laboratory where the plant is housed. Such laboratories should therefore have adequate handling equipment. Small units up to 300 Kv. can be built as mobile outfits if protection for personnel can be provided. A Gamma-ray unit is readily transportable, and castings may be examined upon any convenient site.

Maintenance and Operation.

An X-ray set is a specialised piece of electrical apparatus, and the services of the makers of the set should be available in the event of a breakdown. A Gamma-ray unit does not require such servicing, but the responsibility for the use of both X-ray and Gamma-ray apparatus should be in the hands of a competent radiologist.

Scope and Limitations of Applications

Type of Casting to be Examined.

X-rays are preferably used to examine castings below one inch in thickness and castings requiring the most critical inspection for fine flaws. Gamma-rays are preferably used to examine large and complicated castings where X-ray examination is not readily possible, and commercial castings upon which a highly critical examination is not required.

Type of Flaw to be Detected.

In general, X-ray and Gamma-ray methods are capable of detecting the following types of defects in castings:—Hot tears, shrinkage cavities, gas holes or blow holes, sand or slag inclusions, cracks, lack of fusion due to chills or chaplets. Laminations and fine cracks are difficult to detect and may require special techniques.

In general, gamma radiographs require more skill in interpretation than X-radiographs. Radon and Radiothorium sources enable greater definition than is possible with a radium source.

Cost of Operation

X-ray tubes have a limited life and need to be replaced periodically. Radium units are virtually everlasting and do not require replacing. Radon units have an effective life of about 7 days (half life period 3.8 days), and need regular replacement. Radiothorium has a greater effective life period than Radon, its activity being reduced by half in 1.9 years.

The approximate cost of operation for one X-ray set rated at up to 400 Kv., in a department employing one radiologist and two assistants, would be £2,000 to £2,500 per annum. With a Radium Gamma-ray unit one radiologist and one assistant would be required, entailing an approximate yearly operating cost of £1,500.

The Use of Fullers' Earth in Foundries*

The Functions of special clay in sand preparation

By L. V. Roy

Introduction

Few people realise the antiquity of the Fullers' Earth industry. It may not date back to the Bronze Age in pre-historic times as no doubt the foundry industry does, but it is mentioned in the Bible and in the classical literature of the Greeks and Romans. In those days it was used as a detergent, and the present name is taken from the Latin word "Fullo," who was in effect the laundryman who was responsible for cleaning soiled clothes as well as for the finishing of new cloth. It is almost certain that it was the Romans who, during their occupation of Britain, discovered the deposits in Surrey, which are still being used by The Fullers' Earth Union to-day.

During English history, fullers' earth has played an important part in establishing this country's reputation in the woollen industry—an industry on which to a very large extent the early prosperity of this country depended. The use of fullers' earth in the textile industry gave its name to the fulling process and established the name fullers' earth for this particular type of mineral.

It was considered of such importance to this country that in the 17th Century the export of fullers' earth was forbidden by Act of Parliament to prevent foreign competitors from producing the same high quality woollen cloth which was produced here by the fulling process, that is, beating the cloth in the slurry of fullers' earth. The penalty was a fine of 3s. per pound weight of fullers' earth exported. This Act was periodically amended and brought up to date and was finally repealed in 1861. To-day fullers' earth and products made from it are exported in quantity and it earns valuable foreign exchange.

Historical Development

In 1868, a chemist, called Fordred, who lived at Blackheath, discovered and patented the use of fullers' earth for refining oils. Soon British fullers' earth was used all over the world for refining animal and vegetable oils and fats, and the exports for this purpose are still considerable. Later, the petroleum industry found specially treated fullers' earth valuable in some processes, and now all the better grades of lubricating oil are treated with it to improve their colour and remove gum forming products. Since that time many methods of treating fullers' earth to increase its efficiency for oil refining have been found, as well as many other uses for this mineral, and the industry has changed from simple quarrying into a modern chemical industry.

The use of fullers' earth and the closely related mineral, Wyoming bentonite, in foundry sands, was developed in the United States of America shortly after the 1914/1918 war. Its use in this country grew, and by 1939 Wyoming bentonite was being imported and used in synthetic moulding sands by a number of British foundries.

Some time before the war, in The Fullers' Earth Union Laboratories, Mr. R. H. S. Robertson had been carrying out research work on the production of a highly swelling clay of the Wyoming bentonite type. In 1941 fullers' earth products were supplied commercially as a result of the foundry trials arranged with the help of the Iron & Steel Institute.

The development work was done skilfully and energetically by Mr. S. G. Henderson with full and valuable co-operation from the foundries. The first grades of Fulbond† were from Somerset and Surrey raw materials respectively, which are fullers' earth manufactured under special conditions to bring out the properties most useful in moulding sands. Other grades carrying distinguishing numbers were later developed.

The use of fullers' earth by foundries grew rapidly and continues to grow; in fact this material, developed first as a substitute for Wyoming bentonite to save valuable dollars and shipping space, is now amongst the principal clay bonding materials used in the British foundry industry.

Foundry Use of Fullers' Earth

The four main uses of fullers' earth in foundries are:—(1) For bonding synthetic moulding sands; (2) for strengthening natural moulding sands; (3) for semi-synthetic sands, and (4) for use as a core sand binder in conjunction with an organic binder.

Before considering the use of fullers' earth in detail, it is desirable to state briefly the properties of clay minerals in general and montmorillonite in particular. Clay is the chief bonding agent in moulding sands, and should possess good plasticity, good durability, good spreading properties, so that a thin film readily coats the silica sand grains, and should be capable of regenerating itself by the adsorption of water after drying. These properties follow from the structure of the clay minerals. Clay minerals differ from all other minerals in one important aspect, and that is the size of the regular crystalline fragments in them. While most minerals habitually develop crystals ranging from a few millimetres up to several metres, clay minerals seldom have larger crystals than 1 to 2 microns. The

* A paper presented at the Sheffield Branch of the Institute of British Foundrymen. Mr. H. S. W. Brittain presiding.

† "Fulbond" is a trade mark, the exclusive property of The Fullers' Earth Union, Limited.

Fullers' Earth in Foundries

small size of the crystallites produces large surface forces and an immediate effect is high adsorption power for water which, in turn, gives the properties of plasticity, green strength and others desirable in a foundry sand.

Structure of Montmorillonite

Chemically, clay minerals are hydrous aluminium or magnesium silicates and are built up in layers, the main building unit being a hexagonal net of silicon and oxygen atoms. These nets or sheets of silicon-oxygen are usually joined through oxygen atoms to similar sheets containing the hydroxides of metallic atoms. In montmorillonite which is the base of fullers' earth and bentonite, the main foundry bonding clay minerals, there are two silicon-oxygen sheets and one aluminium hydroxide sheet between them. In kaolinite, which is the major constituent of china clay, fire clays and many natural moulding sands, there are only two sheets in each unit, one silicon-oxygen, the other aluminium hydroxide. The structure of montmorillonite is unusual in that it is chemically unbalanced owing to replacements of some of its atoms by atoms of lower valency, mainly aluminium by magnesium.

To regain chemical balance, they usually attract external positive ions, mainly calcium or sodium, which are situated on the surfaces of the silica nets and act as exchangeable ions. When the exchangeable ions are calcium, the montmorillonite clay is fullers' earth, when they are mostly sodium, the clay is swelling bentonite. These external ions, especially the sodium ions, enhance the water adsorption capacity of the clay and enable montmorillonite to take up about 30 per cent. of its weight of water without becoming obviously wet. The water also builds sheets parallel to the main structural units of the clay and the result is a single dimensional swelling of each clay particle as the number of water layers increases. Thus, on becoming wet, most of the clay particles finally cleave apart, whilst under the same conditions only a small proportion of kaolinite flakes separate and, in consequence, montmorillonite disperses better and will coat the sand grains with an even, thin film of clay more readily than other materials that are not dispersed so well.

The type of clay present has a direct bearing on many of a sand's properties. Many foundry sands fail in practice because the type and characteristics are unsuitable. The moisture content of a sand mix intended for green sand moulding also has a great influence upon its physical properties, therefore only a limited range of moistures is permissible if the best results are to be obtained.

Sand Preparation

Good sand preparation is as essential as good raw material. In order to develop the maximum physical properties in the minimum time, moulding sand, irrespective of its type, requires correct preparation. As is well known, the ideal moulding sand is one in which the silica grains are evenly coated with a moist, plastic clay, because the sand in this condition utilises the bond to its best advantage and develops the maximum value of many of its properties. Like all other clay bonding materials, Fulbond requires good milling to give the best results. Inadequate milling and mixing are wasteful in a sand system, as part of the clay in the sand mix will be burnt out before it has ever had a chance of developing its strength.

There are many methods of mixing foundry sands, the type adopted depends upon several factors—the class or size of work to be handled, the type of sand used and the amounts required. Mixing mills of the roller type are the most common and, if suitably designed, have proved to be the most efficient for clay bonded sands.

Some of the smaller foundries are without a sand mill or mixer of any kind and, in consequence, have to resort to shovelling and riddling the sand. Fullers' earth has a very useful application under these circumstances and, if sprinkled over the heaps and thoroughly mixed in, will increase the bond appreciably overnight. This allows the Fulbond properly to absorb the moisture. Under these conditions, it is necessary to increase the fullers' earth content for a particular strength to counteract the effect of less thorough mixing. Alternatively, a good method is to prepare a rich sand heap, including a high percentage of fullers' earth. This can be placed in a bin and used by the moulders as required. It is only necessary to sieve this richly-bonded sand over the heap and mix it thoroughly.

"Life" of the Sand Bond

A well-milled properly-tempered sand may be bonded to the correct strength, possess all the other physical characteristics necessary to produce good castings and the first castings poured may be almost perfect; yet every foundryman knows that, with continued use of any sand, the sand heap undergoes changes that materially affect the type of casting produced. Obviously, therefore, choice of clay bond cannot be made solely on the basis of the properties of the newly-bonded sand and the castings it first produces.

It is equally well-known that, while measurement of the amount and cost of bond required to produce a certain green strength in the sand will provide a basis for evaluation of different bonds, this cost factor may be considerably altered by the burning out of the bond or by the degree to which it is capable of regeneration after each casting cycle.

If a clay breaks down, it is no longer capable of regeneration by the addition of water and remains in the sand as an increasing quantity of fine inert powder. As the clay loses its bonding power the moulding sand loses its strength and fines accumulate in proportion to the clay lost; for instance, the clay in natural sands, because it contains far more kaolinite than montmorillonite, tends to break down more quickly and, in consequence, many other important properties are lost. To counteract this failure, three courses are available:—(1) Select a suitable natural sand and at definite intervals add a clay such as Fulbond to counteract the natural clay breakdown with its consequent loss in physical properties. The added clay should be of the

montmorillonite type to reduce the quantity needed and therefore reduce the build-up of clay to a minimum. (2) To eliminate the inferior type of clay completely, select a suitable base silica sand and add a sufficient quantity of clay bond which will produce the maximum development of the required properties. Modern practice is in favour of synthetic sands because their properties can be controlled more accurately. (3) These measures can be combined and, by making up sand losses wholly or partly with used core sand instead of new natural sand, a semi-synthetic sand is built up in the foundry.

Natural Sands Strengthened with Fullers' Earth

In addition to its valuable use with synthetic sands, to be dealt with later, fullers' earth can be used with equal success as a strengthening agent in iron and non-ferrous foundries where the practice is based on natural sand. This method is now used frequently and small quantities of fullers' earth are added to the chosen natural sand in foundries which cannot use synthetic sand owing to their small output or lack of elaborate sand handling equipment. By so doing, the sand can be fairly easily maintained at whatever strength be desired and the fullers' earth additions help to counteract the natural clay breakdown. This practice greatly reduces the amount of new sand needed in the shop. The amount of fullers' earth necessary is not very large—about ½ to 1 per cent. is the usual addition. The actual amount is governed by three factors:—(1) Type and size of job which governs the sand strength required; (2) the ratio of metal to sand per box; and (3) equipment for conditioning the sand.

Providing such practice is logically applied, a considerable saving and reduction of labour can be effected in handling the sand and the mill loading is greatly eased. Improved control over the sand is obtained—strength can be increased very quickly for deeper lifts and only a little new sand is needed to replace sand losses on the foundry floor, probably about 2 to 3 per cent. In effect then, there are two methods by which the burned out clay content in natural sands can be replaced:—(1) To introduce new sand to the reclaimed sand; and (2) a small addition of fullers' earth to the reclaimed sand.

The first method is the old traditional one, whilst the second is comparatively new. The difference in the cost factor over a year is significant and decidedly in favour of the second method; for instance, something like 20 per cent. by weight of new sand is required to restore the original green strength of the reclaimed sand after each casting cycle, as against approximately 0.5 per cent. to 1.0 per cent. of montmorillonite clay.

There is one point to guard against when adding clay bond, irrespective of whether it is to a synthetic or a natural sand base, and that is the use of excess amounts, over and above those required to develop the desired properties, which decrease flowability, therefore a considerable increase in force is required for ramming, and in the case of machine moulding in particular, gives a tendency to non-uniform packing of the sand, *e.g.*, the sand may pack very hard on the flat mould faces and be too open on the sides.

The Use of Fullers' Earth with Synthetic Sands

A synthetic sand is a mixture of a base silica sand and a clay bond. One of the most important features of synthetic sands is that proper and accurate control can be maintained at all times. In the past, natural sands have been predominant because there has not been a satisfactory alternative; but now it is possible to select a suitably graded base silica sand and, by adding the required amount of special clay and water, maintain the desired physical properties which are needed to produce good castings. Usually, there are many disadvantages connected with natural sands as received in the foundry, high moisture content, non-uniform grain size, low sintering point, unequal clay distribution and insufficient or excess clay content with a consequent rapid loss of plasticity. A further disadvantage is the fairly high percentage of impurities invariably present in natural sands.

The value of Fulbond can readily be seen, when the high clay content of a natural sand, which is often in the neighbourhood of 15 per cent., is compared with a synthetic sand containing 5 or 6 per cent. of Fulbond for the same green strength. In the same way one can also see the serious effect of clay breakdown on permeability, flowability and many other properties when using natural sands with a high clay content.

Tendency to Drying-out

There is a general belief amongst foundrymen that synthetic sands have a greater and more rapidly developed tendency to dry out than have natural sands. The explanation is that, whereas the average moisture content of a synthetic sand is approximately 3.5 to 4.0 per cent., a natural sand usually contains some 7.0 per cent. of moisture. Assuming, then, two sand mixes: (*a*) A synthetic sand at 3.5 per cent. moisture, and (*b*) a natural sand at 7.0 per cent. moisture; and if each loses 1.0 per cent. moisture by evaporation, then obviously the synthetic sand would feel the drier of the two, the loss of moisture, however, is the same.

Synthetic sands develop their maximum green strength with a low moisture content and, whilst the advantages of this are numerous, there emerges one disadvantage—a tendency to dry out on the surface, leaving a crusty feel. Natural sands with their kaolinite clay content permit a great deal of water migration, which results in the sand being workable after standing for long periods, whereas synthetic sands, by virtue of their limited water migration, tend to air-dry on the surface. To overcome this, a small percentage of cereal binder can be used in conjunction with the special clay. This has the effect of assisting moisture retention on the surface of the sand and at the same time removes some of the crusty feel. The cereal binder requires an increase in water content which improves the feel and texture of a sand.

Cereal in small amounts, of the order of ¼ per cent., increases the green strength of a sand. This green strength increase is partly due to the cereal absorbing a considerable amount of water, thus allowing the fullers' earth to work at a more effective water ratio, as cereal alone produces but little green strength. It is not, however, the measurable physical properties in

Fullers' Earth in Foundries

which the changes are most noticeable, but in the actual behaviour of the sand during moulding—the improved feel and texture of the sand. The effectiveness of cereal addition decreases rapidly if too much be used and "balling up" is likely to occur. As a result of this action the sand becomes very stiff and unworkable, and there is danger of metal penetration or burning-on.

Use in Semi-synthetic Sands

It is possible to combine the use of fullers' earth for strengthening natural sands and bonding synthetic sands; in fact, many foundries now prefer a semi-synthetic sand, the composition of which can be easily varied according to their own special requirements by using a proportion of silica sand to make up sand losses. As is well known, a high proportion of foundries use a silica sand as a base for core sand, and herein lies a source of economy still unknown to many foundries. The used core sand can be sieved and stored adjacent to the sand mill and used in conjunction with the reclaimed moulding sand plus fullers' earth.

Very often a high permeability has to be maintained and a natural sand is preferred to a synthetic sand; the answer then is a semi-synthetic sand. Here, again, the use of fullers' earth is invaluable, and only a small percentage is required; for instance, the following mixes are typical:—

Reclaimed moulding sand ..	95 lbs.	90 lbs.	80 lbs.
Used core sand	5 lbs.	10 lbs.	20 lbs.
Fullers' earth	0.25 lbs.	0.5 lbs.	1.0 lbs.

These proportions can be adjusted as required, with the obvious advantage that the moulding sand can be maintained in a healthy condition at all times.

The Use of Fullers' Earth in Core Sands

No single bonding agent has the ability to satisfy all the requirements in a core sand; in practice it is necessary to use a combination of two or more bonds to obtain the desired properties. The characteristics required in a core-sand mix are similar to the average synthetic moulding sand; in fact, the latter sand mix, with the addition of a suitable core oil, makes a good core sand. They may lack one important feature, and that is collapsibility. Many core mixes have one obvious weakness—low green strength. Lack of green strength can be the cause of a good deal of lost time and slowing-up of production. A small percentage of Fulbond added to the core-sand mix will improve its green strength and effect a small saving of oil and cereal; but care is needed to preserve the required collapsibility. Most core sands are prepared in a sand mixer and not a sand mill; therefore, only fullers' earth grades with a rapid bond development are recommended for this particular use.

There are still an appreciable number of ironfoundries who do not use an oil compound or similar organic binder in their core sand. They prefer the old method of adding new natural sand to the reclaimed moulding sand and using this as a core sand. Often, large cores of intricate shape are made from such a sand and all is well until the mould is cast. When the casting is ready for cleaning and fettling, the core, or cores, have to be knocked out and, in many cases, this takes as long as the fettling operation due to the excessively high dry strength of the sand. Some of these foundries now find that, by arriving at a balance between the amount of reclaimed moulding sand and the percentage addition of fullers' earth required to make up a core-sand mix, they can almost completely eliminate the addition of new sand and, at the same time, gain these advantages:—(1) More efficient control of green and dry strength; (2) effective reduction of the dry strength whilst still retaining a high green strength; (3) better collapsibility of the cores after casting, and (4) saving of time in the fettling deparument.

Finally, the Author wishes to thank the directors of the Fullers' Earth Union, Limited, for permission to publish this Paper.

Small Oil-sand Cores

Recently, visiting a certain foundry, the writer could not help noticing the number of workers pasting together small oil-sand cores. This operation seemed to him to be superfluous, beside resulting in rather misshapened cores. Enquiries revealed that it was the practice of the foundry to make all oilsand cores in halves and paste them together prior to casting.

This appears to have been a tradition built up from the days of the introduction of this type of sand to the foundry—during the period of the first world war—when the mixtures invariably possessed very little green bond strength and a flat surface was desirable on which to turn out the cores successfully. Consequently all the original boxes which had been in use for the older types of naturally-bonded sand, as well as all new boxes, were constructed to comply with this requirement. Thus, after drying, most cores required pasting together, an operation often taking longer than the actual making of the core.

The use of an oilsand mixture possessing good green bond could be used to eliminate some unnecessary core-jointing work and produce cores of far better shape with greater accuracy. For the occasional job, where even oilsand may not be strong enough, core boxes could be so constructed that a portion, made of metal, could serve as a drying shell—an addition to the first equipment cost, but one which would soon be recouped by the saving of jointing time and improvement in the cores.

THE UNITED PATTERNMAKERS' ASSOCIATION has asked its 15,000 members to report on the shortage of hand tools. The Ministry of Supply is to be informed of the result, which, it is thought, will reveal a serious situation.

THE DIRECTORS OF Baxter, Fell & Company, Limited, entertained some two hundred business associates and members of the staff at a buffet dance and cabaret at the Caxton Hall, Westminster, London, on March 5.

★ Manhole Covers ★

A Compact Specialised Foundry at Dover

By A. R. Parkes

The foundry making manhole covers was sometimes classed by even knowledgeable people as being of lesser account. Perhaps this was because it was thought that the casting of these lines required only the poorest quality of metal and the lowest degree of moulding skill. The castings, too, were apt to be regarded as having a purely local market; certain it was that when they reached the scrap pile their value was grouped with sash-weights, burnt iron and the like. It was then, with a measure of pleasurable surprise, that the writer recently found The Dover Engineering Works, which specialises in these articles, to be an efficient, well-run foundry, where there was shown a high degree of moulding skill, a pride of workmanship, and a production flow worthy of the name "mechanised." The product, too, is of good metal, is cast and fitted to precision standards, and fulfils a high strength specification.

Recent History

It is of interest to examine the recent history of this old-established concern at Dover. During the war it was in a front-line town, where the continuity of 110 years was interrupted at noon, July 3, 1940, by a Government Order saying, in effect:—"Evacuate your undertaking within 48 hours. Leave nothing behind except employees' furniture and the cupolas. Arrange for the latter to be demolished by the Military immediately the Invasion Signal is given." After herculean effort the foundry equipment, tools, moulding boxes, patterns, ladles, the moulders and other personnel, complete with their families, in fact all except the very cupolas, were entrained within the time limit, and spent the rest of the war period as "guests" at Watford; business was carried on as usual.

During the years that followed, the foundry building suffered the fate of most other buildings at Dover and became a complete casualty. When the war finished, the managing director, Mr. V. Elkington, A.M.I.C.E., wished to rehabilitate his foundry and his people. A permit to rebuild was received in July, 1945, and by the end of the year the site was re-roofed, and all was set for the return journey. Then, however, came an unexpected setback—it was one thing to bring back the plant, but the personnel had grown roots in Watford, their Dover homes had been destroyed, and very few elected to return. It was, in consequence, with less than twenty of the original

FIG. 1.—GENERAL VIEW OF THE MAN-HOLE COVER FOUNDRY AT DOVER.

Manhole Covers

staff and of those only eight with moulding knowledge (four of these skilled) that production was re-commenced at Dover just two years ago.

It says much for the skilful perseverance of the management and the nucleus of twenty that there are now some 125 men employed. Their number includes ex-servicemen, ex-farm-hands, ex-bus-drivers, and yet there is to-day in that foundry a will to work and a team spirit which nowhere could be bettered. Output is soaring, and their manhole covers are roofing holes in far away Persia as well as East and West Africa.

Raw Materials and Plant

The re-constructed foundry shown in Fig. 1 is laid out with the cupolas near its centre. These are of the solid-bottom type, skip charged, and are worked to the limit of capacity. An unusual feature is that the stock-yard for coke, limestone, pig-iron, scrap, ganister, sand, etc., is under the same roof as the foundry. This must be a boon in wet weather and such winters as that of 1946-47. There is a rotary-table mechanical-impellor-type cleaning machine, and a batch type sand conditioning plant as well as machines for treating floor-sand. The sand used is synthetic—of local silica plus bentonite. Metal transport is by wheeled-bogie ladles on the concrete floor. On the far side of the stockyard road, which divides the buildings, are the dressing and fitting shop, and the testing and despatch departments. Along one side of the building are the pattern shop and tool room. Only a very few dry-sand cores are used.

Moulding and Patternmaking

Moulding is practically all done in green sand and floor moulding is the rule; a very good finish is obtained on the castings. In addition to plated and loose metal patterns for standard sizes, much use is made of sectional metal patterns for non-standard special covers in all shapes and sizes, some of very large area, and requiring straight-edge alignment and "stopping off." The degree of skill and manual dexterity shown by moulders of comparatively short experience is truly remarkable. These special covers and their frame bars may, for instance, form when assembled, a curved duct-covering, perhaps with several subsidiary ducts leading therefrom at various angles.

The head patternmaker, at present a veteran of 70 odd years, has a very important rôle, for it is he who formulates the working dimensions and transmits his directions to the moulder as to where or where not to stop-off a job, and he also arranges the sequence numbers of runs of castings.

Fitting and Assembly

The manhole covers made at Dover are renowned for the excellence of fit between cover and seating. This has led to their increasing use in specialised applications where their non-rocking quality, air or water tightness are essentials. Such was the case with the many covers that sealed the flotation chambers of the concrete vessels that composed the Mulberry Harbours. In the works, covers are matched with their frames and ground to precision fit one with the other before being sealed in that position for despatch. The seal between cover and frame is not to be broken before they are placed in their final resting place on site. The casting, which is of a patented cellular design, is later filled with concrete, forming, in effect, a reinforced concrete assembly of great strength.

Good Housekeeping

In this manhole-cover foundry good housekeeping is more in evidence than are other amenities of possibly greater propaganda value. Baths and showers are on the list of things to come when building conditions permit. In operation now are neatness and orderliness of production, good lighting, protection from the weather, packed meals, rest and refreshment periods, a training scheme for apprentices and an improvement scheme for the less versatile of operators. All these tell their story of improved co-operation within the organisation and by which the appellation a "family business" is most truly epitomised.

An Extensive Project

As an example of how these manhole covers are used in large installations, the writer was privileged to examine drawings of a project now completed for an aircraft hangar—for the large Brabazon 'plane now being built. Covering the hangar floor is a network of ducting carrying power cables, etc., for pick-up at any convenient point. The covers for these ducts comprise a length of over 1½ miles, besides numerous branch pieces, specials and multiple covers, each of which has to be strong enough to take the weight of the huge aircraft. Each single cover is matched with its frame and with its fellows to suit the site requirements —truly a remarkable feat of jigsaw precision. Thus is revolutionised the old conception of a manhole-cover foundry.

Please Co-operate

A letter received from Mr. W. T. Main, of T. Main & Sons Pty., Limited, iron founders, of Cr. Lambert and Baker Streets, North Richmond, E.1, Victoria, Australia, first asks us to express their united thanks to all those who gave hospitality to his nephew, Mr. A. Main, during his recent prolonged stay in this country. Mr. Main is anxious to reciprocate by offering similar hospitality to any home foundrymen visiting Melbourne. He takes a very keen interest in the recruitment of youth to the foundry industry, and would like to receive details of all our schemes. Thus we should like the I.B.F., the C.F.A., the Manchester Committee, the Mechanite interests, Stanton, Birmid Industries, Manlove Alliott, Allen's of Bedford, and all other similar enterprising concerns to send along to Mr. Main their literature. We personally should appreciate this co-operation.

Free-Cutting Stainless Steel Castings

Modern industrial plant makes extensive use of high alloy-content stainless and corrosion-resisting steels in both the wrought form and as castings, but in the past production engineers have encountered serious machine-shop problems due to the inherent characteristics of these steels, which problems are particularly pronounced in the case of the austenitic corrosion-resisting types.

Limitations of Special Machining Techniques

The development and application of special machining techniques has undoubtetdly shortened the time taken in machining operations, but there are limits to the improvement which is possible from this angle. In fact, many of the precautions necessary in handling this

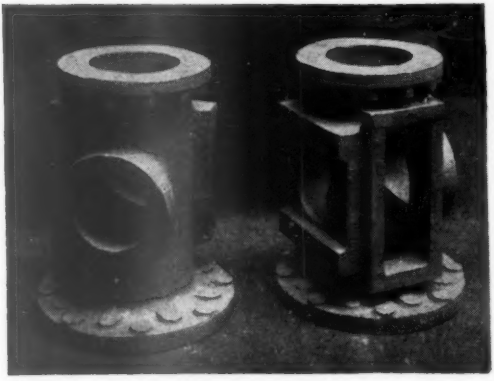

FIG. 1.—STAINLESS-STEEL VALVE BODIES CAST IN THE FREE-CUTTING ALLOY.

class of steel in the machine shops, *i.e.*, special tool mountings and frequent attention to tool grinding, while reducing the actual cutting times have themselves been time-consuming and have impeded output. The most substantial contribution towards solving the problem has been based upon a metallurgical modification involving the addition to these classes of steel of small proportions of special elements, which, in principle, follows the measures taken to improve the machinability of the straight carbon and low alloy steels. These advances, *i.e.*, the production of the "free-cutting" stainless steels, have been exploited in this country to a relatively small degree, and this confined almost exclusively to the wrought form. In recent years, however, aircraft engine development has demanded steels of a very similar nature to the corrosion-resisting category for use at high temperatures, and for reasons of design the components have been produced in the cast rather than the wrought form.

Application to Cast Products

The David Brown Foundries Company, whose research organisation has been mainly associated with the development of these steels, reports that this object has been achieved without reducing to any marked extent the mechanical and other special properties associated with such materials. Fig. 1 shows valve bodies cast in the new free-cutting stainless steel. Emphasis is laid upon the difficulties of defining precisely the extent to which machinability has been improved, on account of the many well-known variables which make the assessment of machinability so complex. From experience in their own machine shops they infer that the improvement is considerable but suggest that this can be best ascertained for particular operating conditions by trial of cast material, which is available in the following types of steel:—

(1) 13 per cent. chromium;
(2) 18 per cent. chromium; 8 per cent. nickel;
(3) 18 per cent. chromium; 8 per cent. nickel; 1 per cent. columbium (weldable);
(4) 18 per cent. chromium; 8 per cent. nickel; 1 per cent. columbium, and 3 per cent. molybdenum (weldable); and
(5) 25 per cent. chromium; 12 per cent. nickel, and 3 per cent. tungsten.

The development is felt to be of considerable importance in relation to present-day circumstances under which both man-power and machine capacity are at such a premium. Any contribution, whether of metallurgical or engineering origin which can in effect give industry a greater output capacity should, without doubt, be given the most serious attention; and production engineers who in the past have experienced the machine shop problems presented by highly alloyed steel castings will no doubt welcome the advent of the free-cutting stainless and corrosion-resisting steel casting.

Protection of Steel against Atmospheric Corrosion and Marine Fouling

A joint meeting of the Iron and Steel Institute and the British Iron and Steel Research Association to discuss several Papers dealing with the protection of steel against atmospheric corrosion and marine fouling will be held at the Institute's offices, 4, Grosvenor Gardens, London, S.W.1, on Thursday, June 17, 1948. Mr. T. M. Herbert, deputy-chairman of the Corrosion Committee and chairman of the Protective Coatings Sub-Committee, will preside at the morning session, and Prof. J. E. Harris, chairman of the Marine Corrosion Sub-Committee, at the afternoon session.

F. ISSELS & SON, LIMITED, of Bulawayo, Rhodesia, now fifty years old, have formed a financial liaison with the John Brown group of Sheffield. Mr. H. G. Issels, who remains chairman, is to be joined by Mr. W. E. Scott Russell, C.A., Mr. Leo Davis and Mr. Eric Mensforth. The firm is a Meehanite licensee.

A Vent that was Missed

By W. Gudgeon

Sometimes one is at a loss to find the cause of scrap castings when the laws governing the making of the mould have apparently been followed. Eventually the fault is traced to a simple oversight and the matter put right by an equally simple remedy.

The job—a gas burner—shown in Fig. 1 (*a*), is of this type of casting that may start one suggesting first one reason and then another for the cause of casual rejections. It is a burner of plain design with a 2-in. dia. core, 2 ft. 2 in. long and tapering to a slit 1 in. long by $\frac{1}{8}$ in. wide at one end. Thickness of metal is $\frac{3}{16}$ in.

The core (*c*) is made in one piece and reinforced with two rods $\frac{1}{4}$-in. dia., one in the top half of the core and the other in the bottom half. A third rod of the same diameter is placed between them to form the vent, shown in Fig. 1 (*b*).

From the outset of the production of these castings about one in every ten was scrap through "blowing," a slight heaving in the metal of the riser being a sure indication that the casting would turn out a "waster." Also, odd ones were found to have slightly "blown" patches when the core was being rapped out of the casting, although with these no heaving in the riser had been noticeable at the time of pouring. Considering the large volume of air freely escaping from the core, "blowing" of the metal was the last thing to expect.

Whilst watching the making of a few of these cores it was observed that the vent wire was not always placed as instructed, that is, $\frac{1}{2}$ in. from the end of the corebox, but at times fell short, the distance varying from $1\frac{1}{2}$ in. to 2 in. from the end. More important still was that the bend at the end of the core was left without a vent.

When the absence of this vent was questioned, the answer was that the air would travel from this small unvented area to the main vent, as witness the large volume passing from the core when casting. Notwithstanding this explanation, instructions were given that two pieces of wax vent were to be placed at the bend of the core, one piece in each half, each piece connected to the large vent, as at A, thereby allowing free escape to what was hitherto simply a pocket of trapped air. As not one "blown" casting out of two hundred occurred since the wax vents were introduced and with the job still in progress, it will be seen how necessary it is to control small factors which at first glance seem unimportant.

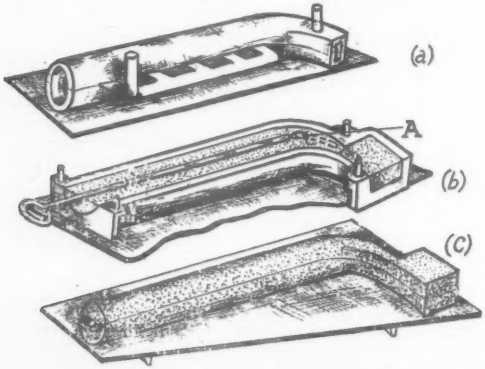

FIG. 1.—MAKING A GAS-BURNER CASTING.

House Organs

The L.M.F.A. Bulletin, No. 4, February, 1948

Published for private circulation. This issue of the Light Metal Founders' Association Bulletin contains an excellent article by Mr. W. C. Devereux. In it he counsels light alloy founders to re-examine their manufacturing programmes to ascertain whether they are engaged upon long- or short-term projects. With the end of the sellers' market, makers of light castings will be better placed if they have firmly established themselves in lines of manufacture where true suitability is the criterion and not just present-day prices and shortages. He is also concerned as to the future supply of the virgin metal, owing to the proximity of the termination of the Canadian contract. Then there is a second article by Mr. G. A. Woodruff on the very considerable activities of the L.M.F.A. Development, Limited, whose main job is to expand the use of light alloy castings. This is a very interesting issue.

The Nickel Bulletin

The first issue of Volume 21 has a new format. The majority of the publication is still devoted to abstracts of published work on nickel and its alloys, but the pre-war practice of including also articles of special interest has been restored. It is appropriate that the first article to appear in the 1948 edition of the Bulletin should deal with the services developed by the nickel industry to assist engineers and designers. The Nickel Bulletin is obtainable free of charge from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

S. WOLF & COMPANY, LIMITED, Pioneer Works, Hangar Lane, Ealing, London, W.5, have designed and placed on the market a new $\frac{1}{2}$-in. general duty portable drill—type SD4c. By means of a stand it can be converted into a drill press.

SIR PATRICK HANNON, M.P. for the Moseley Division of Birmingham, addressed a well-attended meeting of British Engineers' Association members in the Birmingham area at a luncheon at the Queen's Hotel, Birmingham, on March 5.

Lengthening a Gun-Metal Spindle

By G. E. Morse

This article describes a method of burning-on an extra length to a machined gun-metal spindle in the vertical position. The spindle was one inch in diameter and 12 in long., and had to be extended to 20 in. total length. Fig. 1 shows the method used. A wood pattern was turned up 1¼ in. dia. as shown by B, and carrying a recess G. It was ⅜ in. deep and fitted snugly on to the spindle A. This being carefully done, the whole was bedded into a heap of sand, firmly ramming the sand around both components. A flow-off was provided as shown in Fig. 1; for its formation, a stick tapering from ½ in. to ⅜ in. dia. (A1) was used, taking care that it was a perfect fit against the pattern B. After stripping the spindle pattern and stick, a runner bush D was placed in position and a pit F was prepared to receive the overflow. The continuous pouring of hot metal on to the end of the metal spindle at H and G, associated with the evacuation of the cooling metal through the flow-off, melted the top of the bar and formed a perfect "burn-on."

If a hand ladle were used for reclaiming the overflow whilst still liquid, economies could be introduced by pouring back into the melting pot the surplus metal. Obviously metal of the same composition as the original spindle was used. Feeding was effected by stopping up the end of the flow-off with moist sand kept in position by a weight. This done, the runner bush was filled and covered with charcoal and dry sand. The pouring temperature was about 1,150 deg. C., and the amount of metal needed to carry through the job about 60 lb., of which about 75 per cent. was reclaimed by ladling back to the crucible. A second method which might be adopted is by the use of a joint line at the juncture of the spindle to be enlarged, involving the use of a cope moulding box.

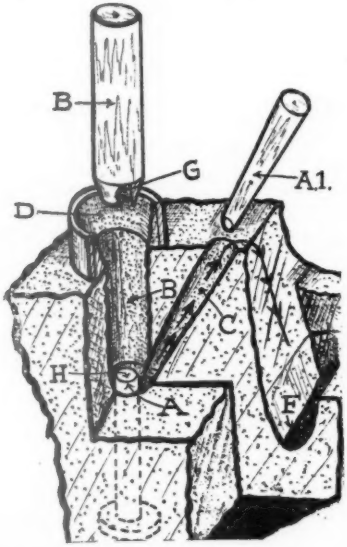

FIG. 1.—PART SECTION THROUGH MOULD ASSEMBLY FOR LENGTHENING GUNMETAL SPINDLE.

Book Reviews

Flow through Standard Nozzles, Orifice Plates and Venturi Tubes. By J. R. Finniecome. Published by Emmott & Company, Limited, 31, King Street West, Manchester, 3. Price 3s. net.

How much the foundryman should know about the measurement of cupola blast and similar problems is a moot point, but for the designer of his equipment and maintenance staff there is a need for a thorough understanding of the matter covered by this textbook. The Author has accomplished an immense amount of work in searching for and presenting the latest reliable data on the subject. He has managed to condense his results into 20 short chapters occupying 84 pages, whilst using 56 diagrams and nine tables.

Palmer's Private Companies (40th Edition). By J. Charlesworth, LL.D. Published by Stevens & Sons, Limited, 119 & 120, Chancery Lane, London, W.C.2. Price 3s.

Any book which has reached its 40th edition needs no reviewer's commendation to extol its worth. It speaks for itself. As the law on this subject has not been revised recently, the information is up to date and reliable.

New Catalogue

Stainless Clad Steel. A four-page folder has been used to introduce a new line of stainless clad steel, by Colvilles, Limited, of 195, West George Street, Glasgow. This comparatively new idea of furnishing composite mild steel to stainless steel plates is a development which must be seriously considered by those foundries manufacturing glass-lined castings. The new material is not brittle and could be dented without impairing its acid resisting properties. It is strong, about 30 tons per sq. in. tensile, and quite ductile. The cladding can be either 18:8 or the straight 14 per cent. chromium steel. The folder is an excellent introduction to the subject, as it shows the major properties and lists potential applications.

Acicular Cast Iron

Foundry executives interested in the production of acicular cast irons (a summary of a Report on their properties was printed in our issue of March 4) should apply to the Mond Nickel Company, Limited, of Grosvenor House, Park Lane, London, W.1, as the material is covered by Patent No. 545,102.

Pig-iron and Steel Production in Great Britain

The following particulars of pig-iron and steel production in Great Britain have been extracted from the Statistical Bulletin for February, 1948, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in January, with the number of furnaces in blast at the end of the month; Table II, production of steel ingots and castings in January, and Table III, deliveries of non-alloy and alloy finished steel. Table IV summarises steel industry activities during six months ended January, 1948.

TABLE I.—*Weekly Average Production of Pig-iron and Blast-furnace Ferro-alloys in January*, 1948. (*Thousands of Tons.*)

District.	Furnaces in blast, 31.1.48	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants, and Essex ..	26	—	14.0	22.7	1.2	—	37.9
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Ches. ..	6	—	6.7	—	—	1.3	8.0
Yorkshire (incl. Sheffield, excl. N.-E. Coast) ..							
Lincolnshire ..	14	—	22.0	—	—	—	22.0
North-East Coast	25	6.8	35.6	0.4	—	1.4	44.2
Scotland	9	0.7	9.0	2.5	—	—	12.2
Staffs., Shrops., Worcs. and Warwick ..	8	—	7.5	1.3	—	—	8.8
S. Wales and Monmouthshire	7	2.8	17.8	—	—	—	20.6
North-West Coast	7	13.9	—	0.2	—	—	14.1
Total ..	102	24.2	112.6	27.1	1.2	2.7	167.8
December, 1947*	100	23.2	109.5	27.3	1.3	3.3	164.6
January, 1947* ..	97	22.0	100.1	23.9	1.5	2.6	150.1

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1946.	1947 (53 weeks).	1947. Jan.*	1947. Dec.*	1948. Jan.
Non-alloy steel :					
Heavy rails and sleepers	9.0	7.6	7.8	7.7	9.1
Heavy and medium plates	30.9	31.6	30.4	31.6	34.0
Other heavy products	31.9	31.7	31.8	32.5	35.0
Light rolled products (excl. wire rods and alloy steel bars) ..	48.9	49.8	49.8	49.9	53.3
Ferro-concrete bars	3.2	3.2	2.5	3.9	3.0
Cold-rolled strip ..	4.2	4.6	4.8	4.3	4.8
Bright steel bars ..	4.5	4.8	4.7	4.8	6.6
Sheets, coated and uncoated	22.4	24.3	25.8	25.3	27.1
Tin, terne and black plate	10.4	12.1	12.8	11.9	14.0
Tubes and pipes ..	14.0	13.2	12.5	13.6	14.2
Steel wire	11.8	10.8	11.5	10.5	11.8
Tyres, wheels and axles	3.4	3.5	3.6	3.7	3.1
Forgings	4.9	5.0	5.0	5.5	5.2
Castings	2.9	3.0	2.8	3.3	3.1
Total	202.4	205.2	205.8	208.5	224.3
Alloy steel :‡					
Plates	0.3	—	—	0.1	—
Tubes and pipes ..	0.2	0.3	0.3	0.4	0.5
Bars, sheets, strip and wire	2.9	3.7	3.3	4.1	4.3
Forgings	1.6	1.8	1.8	2.2	2.0
Castings	0.6	0.6	0.6	0.7	0.6
Total	5.6	6.4	6.0	7.5	7.4
Total U.K. production†	208.0	211.6	211.8	216.0	231.7
Less Intra-industry conversion ..	16.4	17.9	15.8	22.3	24.9
Total U.K. deliveries	191.6	193.7	196.0	193.7	206.8
Add Deliveries of imported finished steel	—	2.3	—	2.5	1.5
Total deliveries of finished steel ..	191.6	196.0	196.0	196.2	208.3

† Includes finished steel made from imported ingots and semi-finished steel. ‡ Excludes high-speed steel.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in January*, 1948. (*Thousands of Tons.*)

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants, Essex ..	—	—	(Basic) 9.7	1.4	0.2	10.7	0.6	11.3
Lancs. (excl. N.-W. Coast), Denbigh, Flints., Ches.	1.5	21.4	—	0.5	0.4	22.9	0.9	23.8
Yorkshire (excl. N.-E. Coast and Sheffield)								
Lincolnshire	—	28.7	—	—	0.1	28.7	0.1	28.8
North-East Coast	2.0	52.3	—	0.7	0.5	54.1	1.4	55.5
Scotland	3.9	32.7	—	1.5	0.6	37.3	1.4	38.7
Staffs., Shrops., Worcs. and Warwick	—	13.9	—	0.6	0.9	14.0	1.4	15.4
S. Wales and Monmouthshire	8.9	44.7	(Basic) 4.7	0.9	0.1	59.0	0.3	59.3
Sheffield (incl. small tonnage in Manchester) ..	9.0	23.1	—	7.4	0.6	38.4	1.7	40.1
North-West Coast	0.6	2.2	(Acid) 4.8	—	0.1	7.6	0.1	7.7
Total	25.9	219.0	19.2	13.0	3.5	272.7	7.9	280.6
December, 1947*	23.2	187.5	18.4	11.1	3.0	236.1	7.1	243.2
January, 1947*	22.8	185.8	17.8	10.4	3.0	233.0	6.8	239.8

*Five weeks.

(*Continued at foot of facing page.*)

February Iron and Steel Output

Steel production in February was at the rate of 15,049,000 tons a year, compared with 14,589,000 tons in January and 10,726,000 tons in February, 1947, the latter month being affected by the fuel crisis. February last was the first month in which steel production has exceeded a rate of 15 million tons a year, the present figure being well above the previous record of 14,589,000 tons reached in January.

Production of steel has been running for the first two months of the year at a level above that needed for the 14-million-ton target, even after allowing for a fall in production during the holiday periods.

Pig-iron production again shows a welcome improvement and, at 9,169,000 tons, is close to the target rate of 9,200,000 tons. The February output compares with a rate of 8,726,000 tons in January and 6,560,000 tons a year ago.

Latest output figures compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1948—January ..	167,800	8,726,000	280,600	14,589,000
February ..	176,300	9,169,000	289,400	15,049,000
1947—January ..	150,100	7,806,000	239,800	12,470,000
February ..	126,200	6,560,000	206,300	10,726,000
4th quarter ..	163,600	8,505,000	263,100	13,679,000
1946—4th quarter ..	154,400	8,029,000	251,700	13,088,000

Americans Urged to Manufacture in Britain

Mr. Alfred Edwards, Labour M.P. for Middlesbrough East, and a Tees-side industrialist, who has returned from a visit to the United States, said in an interview that he had been urging that it would be better for American firms to put down plants in Britain than for Britain to import from America. Mr. Edwards said that the only thing which would frighten away the Americans was any threat of further nationalisation, but he had assured them that nationalisation in Britain was not likely to go any further, as the Government was committed to only 20 per cent., and this was nearly completed.

Provisions Under the Companies Act, 1947

The Board of Trade has made an Order appointing July 1, 1948, as the date on which all the provisions of the Companies Act, 1947, not then in force will come into force. The same Order has brought into force Section 120 (2) of the Act, which empowers the Board of Trade to make regulations altering or adding to the provisions of certain schedules to the Companies Act, 1929. Under these powers, regulations have been made, with effect also from July 1 next, amending Table A and the form of annual return. The revised Table A and form of annual return will be included in the schedules to the Bill to consolidate the Companies Acts which were introduced in the House of Lords on March 8.

The Companies Act, 1947 (Commencement) Order, 1948 (S.I. 1948, No. 439) came into force on March 2, while the Companies (Articles of Association and Annual Return) Regulations, 1948 (S.I. 1948, No. 434), comes into force on July 1, 1948.

Scientific Delegation for Australia

Sir Ben Lockspeiser, chief scientist of the Ministry of Supply, who will lead the U.K. delegation at the first meeting of the Commonwealth Advisory Aeronautical Research Council which is being held in Australia during April, will also take the opportunity of discussing research matters relating to defence with the Australian and New Zealand Governments.

The British delegation will comprise Mr. W. G. A. Perring, director, Royal Aircraft Establishment; Mr. A. Fage, National Physical Laboratory; Prof. A. R. Collar, Bristol University; Mr. H. B. Howard, an assistant director of research and development, Ministry of Supply; Mr. G. C. Ashworth, administrative assistant to the chief scientist of the Ministry; and Mr. R. W. Gandy, secretary to the delegation.

THE DIRECTORS OF Baxter, Fell & Company, Limited, iron, steel and mineral merchants, etc., of Minories, London, E.C.3, entertained some 200 business associates and members of the staff at a buffet dance and cabaret at the Caxton Hall, Westminster, on March 5.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN (*Continued from previous page.*)

TABLE IV.—*General Summary of Pig-iron and Steel Production.* (*Weekly Average in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			Steel stocks.†
						Imports.	Output of ingots and castings.	Deliveries of finished steel.	
1938	228.1	89.2	—	130.0	117.9	16.2	200.0	—	—
1946	234.1	115.4	169.2	149.3	147.0	8.3	244.1	191.6	1,223.9
1947 (53 weeks)	209.2	129.9	165.1	146.9	145.2	8.0	240.1	196.0	1,067.5
1947—August	206.8	127.6	164.8	147.2	138.7	5.5	234.2	177.6	816.1
September ..	220.2	129.6	162.7	150.1	161.5	8.0	266.1	204.8	800.4
October*	226.3	144.5	174.6	160.6	166.4	5.1	275.3	209.7	782.0
November	225.0	153.5	185.6	165.9	164.2	8.3	272.6	214.1	789.2
December*	223.6	149.2	188.2	164.6	144.9	5.8	243.2	196.2	775.0
1948—January	238.9	153.7	195.9	167.8	168.8	4.3	280.6	208.3	796.7

* Five weeks. † Stocks at the beginning of the years and months shown.

Factors Affecting Economic Recovery

Government Urged to Reduce Expenditure

The National Union of Manufacturers has issued an urgent appeal to the Chancellor of the Exchequer to stop at once every phase of Government activity and every one of its projects not necessary to the national recovery. The memorandum expresses the Union's gratification that the Government has at last recognised the needs for a wages policy. "But there remains the question of national expenditure upon which the White Paper is unfortunately silent," it states, "and this constitutes a most serious menace to our economic recovery and indeed a main cause of the financial predicament in which we find ourselves to-day."

The Union calls for a rigorous overhaul and pruning of national and local government expenditure, coupled with a drastic reduction of the number of people in those services. The memorandum states that the present level of taxation in a time of peace is far too high and undoubtedly is a brake upon production, and the Union holds the view that a reduction in the standard rate of income tax, which should easily be possible if there is proper economy in Government expenditure, would be such an incentive to production on the part of employer and employee alike that it would more than offset the disadvantage of the addition made to the nation's spending power.

"At the present time there is a necessary restriction on capital expenditure, and this unfortunately has to include capital expenditure on industrial development and improvements." The memorandum continues: "But this cannot go on for more than a relatively short time or British industry will find itself grievously handicapped in its competition with the industries of more fortunate countries. The industrialist must retain in his business the capital necessary to undertake the required modernisation and improvements as soon as he can be permitted to carry them out, and he should be encouraged to make fully adequate reserves for this essential purpose. The National Union therefore couples its recommendation regarding the standard rate of income tax with a strong plea that there should be no further increase in the profits tax and especially in that part of the tax which falls on undistributed profits."

The statement ends with the suggestion that, with the present restriction on capital expenditure, there should be an extension of the period within which charges for deferred repairs can be related back to an assessment for E.P.T.

FULL DETAILS of the recently concluded trade pact with Denmark, covering the period January 1 to September 30, 1948, show that the United Kingdom has agreed to deliveries of iron and steel at the rate of 50,000 tons per annum, and coal at the rate of 870,000 tons per annum, during the period covered by the agreement.

Iron and Steel Scrap Inquiry

Appointment of Committee

Mr. G. R. Strauss, Minister of Supply, stated in the House of Commons that the general scrap position had improved slightly in recent weeks, but the longer term outlook remained serious. Accordingly he had decided to appoint a committee of three members, drawn from outside both Government departments and the steel industry, to consider and report on what special measures could be taken to secure increased supplies. He had been fortunate in securing the services as chairman of the committee of Sir Graham Cunningham, who was Controller-General of Munitions Production in the Ministry of Supply during the war; the other two members would be Lt.-Gen. Sir Kenneth Loch and Dr. Slade. Mr. A. F. Barnes, of the Iron and Steel Board, would be secretary to the Committee, which was to begin work at once.

Mr. Renton asked if the Minister could say whether he had considered the possibility of using as scrap the Japanese warships referred to in a very recent White Paper as being redundant, and which apparently were being scrapped a long way from here, but which might very well be sailed here and used for scrap.

The Minister said he did not know whether it had been specifically considered. He doubted whether it would be of great value; they had a considerable supply of scrapped battleships—the enemy's and our own—with which they had to deal in the next 18 months or so, and he did not think they could deal with much more than they had already got.

Mr. Willis asked if Mr. Strauss could say whether it was still expected that we might get a million tons of scrap from Germany this year, to which the Minister replied that he doubted whether we should get as much as that, but they wanted to get as much as they could during the coming year.

Contracts Open

The dates given are the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Cockermouth, March 24—Supplying and laying approx. 11,908 yds. of asbestos-cement pressure pipes and approx. 1,840 yds. of 3-in. dia. spun-iron concrete-lined pipes, etc., for the Rural District Council. Mr. A. E. Simpson, engineer, Council Office, Cockermouth, Cumberland.

Feltham—Gulley grates and frames, manhole covers and frames, etc., for the Urban District Council. Mr. L. J. Grimshaw, engineer and surveyor, Council Offices, Feltham, Middx.

Fife, April 26—Construction of a trunk sewer, together with storage tanks, sea outfall pipe, etc., for the County Council. Blyth & Blyth, consulting engineers, 135, George Street, Edinburgh. (Fee £5 5s., returnable.)

Newark, March 26—Provision and laying of iron pipe water mains, for the Rural District Council. Elliott & Brown, Stanley House, Pelham Road, Nottingham. (Fee £3 3s., returnable.)

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Personal

DR. MORRIS REED has been appointed chief radio engineer of the Mitcham works of Philips Electrical, Limited.

SIR GEORGE JESSEL has accepted the chairmanship of Parkinson & Cowan, Limited, in succession to LT.-COL. H. W. WOODALL, who has retired owing to ill-health.

MR. W. LAING has received a presentation to mark the occasion of his retirement from the Blyth Dry Docks & Shipbuilding Company, Limited, after 55 years' service.

MR. R. M. MATHESON and MR. H. H. PHILLIPS have been elected directors of the Bristol Tramways & Carriage Company, Limited, in place of MR. GEORGE CARDWELL and MR. K. W. C. GRAND, who have resigned.

PROF. F. J. M. STRATTON, F.R.S., is accepting a temporary appointment as deputy to the Scientific Adviser to the Army Council. He has lately retired from the Professorship of Astrophysics at Cambridge University.

MR. E. P. PAXMAN, managing director of Davey Paxman & Company, Limited, engineers, ironfounders, etc., of Colchester, has been elected chairman of the newly-created Colchester District Advisory Committee for Industry.

MR. C. H. DUMBLETON, a director of Baker Perkins, Limited, manufacturing engineers, etc., of Peterborough, has returned to this country after a 10-week trip to Brazil, the Argentine, Peru and Chile to extend the company's markets there.

MAJOR CHARLES PRATT, a director of Blackstone & Company, Limited, manufacturers of Diesel engines, agricultural and general engineers, etc., of Stamford, Lincs, left for South Africa on March 4. He is making the trip partly for business and partly for health reasons.

MR. E. B. HILL, of Charles Hill & Company, Limited, brassfounders, etc., of Birmingham, has been elected chairman of the Zinc Alloy Die Casters Association for 1948. He will be assisted by the retiring chairman, MR. A. E. MILLS, of the British Die Casting & Engineering Company, Limited, and by MR. J. W. CARTLIDGE, of Dyson & Company, Enfield (1919), Limited, manufacturers of diecastings, who was at the same time elected chairman designate to succeed Mr. Hill at the end of his term of office. Mr. Mills and Mr. Cartlidge will act as deputy chairmen.

SIR JOHN COLVILLE has accepted an invitation to join the board of Colvilles, Limited. He will thus renew an old connection with the firm, for he was elected a director of David Colville & Sons, Limited, in 1920, and retired in 1931 when he was appointed Secretary to the Department of Overseas Trade. He is a grandson of the founder of the company, and his father was the first chairman of David Colville & Sons. Sir John, who received a barony in the New Year Honours, will shortly take his seat in the House of Lords as Lord Clydesmuir of Braidwood, in the county of Lanark.

Increased Production in Ironfoundry Industry

Improved Labour Force

A survey of the ironfoundry industry issued by the Ministry of Supply reveals a considerable improvement in the labour force in the industry, and a large increase in production. Labour figures for total process and maintenance workers at various dates are given as follow:—January 4, 1947, 127,062; April 5, 1947, 130,648; July 5, 1947, 131,366; October 4, 1947, 134,292; January 10, 1948, 138,168. The total increase over the year equals 11,106, but there are still large outstanding demands for both skilled and unskilled operatives.

As an indication of output per man, two peak production periods have been taken into account, *i.e.*, the last quarter of 1946 when output equalled 709,498 tons with a labour force of 127,062, and the last quarter of 1947, when output equalled 809,486 tons with a labour force of 138,168. These figures represent respectively 5.58 tons and 5.86 tons per operative. The survey states that an important point to be taken into account is that up to the end of 1946 the industry was working a 47-hr. week, whereas from January 1, 1947, a 44-hr. week was in operation. The figures show, therefore, a higher output per man-hour on the reduced working hours.

Production over the four quarters of 1947 was as follows:—First quarter, 630,219 tons; second quarter, 714,787 tons; third quarter, 691,533 tons; fourth quarter, 809,846 tons. The above figures show a total production for the year of 2,846,385 tons, with the last quarter representing an annual output of 3,000,000 tons, compared with the last quarter of 1946, which represented an annual output of 2,638,000 tons.

The principal increases show the efforts which have been made by the industry to meet priority demands. The increases have mainly been on the following products:—Cast-iron pipes and fittings; agricultural castings; colliery castings; electric industry; chemical plant and atomic energy; gas-producing plant; railway castings, and iron and steel works' plant.

Recent Wills

STANFORD, JOSEPH, of Stoke-on-Trent, blast-furnace contractor £1,479

WIX, F. R., a director of the Phosphor Bronze Company, Limited, Birmingham £39,982

PHILLIPS, J. R., a director of Blair, Campbell & McLean, Limited, engineers, ironfounders and coppersmiths, of Glasgow £4,111

ALLCOCK, H. J., deputy to the production director of British Insulated Callenders Cables, Limited, chairman of the transmission section of the Institution of Electrical Engineers, 1940-41, and formerly liaison officer at the Westinghouse Electric Company, East Pittsburgh, U.S.A., on behalf of the Metropolitan-Vickers organisation £7,307

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News in Brief

THOMAS SMITH & SONS OF SALTLEY, LIMITED, drop forgers, etc., of Birmingham, is to celebrate the centenary of the founding of the company to-morrow (Friday).

THE BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED, is to provide electric light in a town in Saudi-Arabia where until now oil lamps have been the main source of illumination.

THE SCOTTISH COUNCIL (DEVELOPMENT AND INDUSTRY) is considering the question of staging an experimental Scottish Industries Fair in the summer of 1949 if the firms interested so desire.

THE FOLLOWING interim allocations of tin metal have been made by the Combined Tin Committee for the first half of 1948:—South Africa, 280 tons; Rumania, 80 tons; Mexico, 80 tons; Pakistan, 140 tons; Yugoslavia, 110 tons.

AN 80-FT. LONG fusion welded boiler, weighing 83 tons, has been despatched from the Renfrew Works of Babcock & Wilcox, Limited, for Teddington, Middx. The boiler is the largest to be taken from the makers by road.

THE CONSETT IRON COMPANY, LIMITED, has put into operation an addition to its Fell Coke Works, Co. Durham. The new extension comprises 54 ovens and by-product plant and has taken two years to build. Together with the existing plant, it will produce 15,000 tons of coke a week.

MOORWOODS, LIMITED, brass and iron founders, of Sheffield, is making extensions to its foundry. New plant and machinery are being installed which will enable the company to produce 60 tons of finished castings per week. Hot baths will be available for the workmen when the extensions are completed.

PLANS FOR AN additional workshop, to be built at a cost of between £40,000 and £50,000, at the Whifflet foundry of R. B. Tennent, Limited, Coatbridge, have been approved. The extension is part of a development scheme to build within the next four years, at a cost of about £500,000, modern rolling-mill plant.

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Glasgow, is to build the mechanical portion of a locomotive for the Portuguese railways. This is part of an order—the first for electric rolling stock ever placed with a British company—secured by the General Electric Company, Limited, and includes motor and trailer coaches as well as the locomotive.

A REPORT ON welding problems as a result of research carried out at Birmingham University under the supervision of Prof. D. Hanson, and at the request of the Wrought Light Alloys Development Association, Birmingham, has now been published. Research at the university is to continue under the sponsorship of the Aluminium Development Association.

A BETATRON (atom-splitting machine), has been accepted by Oxford University from the research department of the British Thomson-Houston Company, Limited. The new instrument puts at the disposal of scientists more energetic electrons than have been available in university laboratories hitherto. The machine is being installed underground in the Clarendon Laboratory.

VICKERS, LIMITED, has purchased for £750,000 one of the oldest established engineering works in Victoria, Australia, Charles Ruwolt Proprietary, Limited. Founded by the late Charles Ruwolt, the present company was formed in 1920 and has acquired a high standing as suppliers of structural steel, stone crushers, and a wide variety of heavy industrial equipment. The company's issued shares total £176,000.

AN APPLICATION for a wages increase for women employed in general engineering work throughout the country was decided upon at a meeting in London on March 8 of representatives of the four big unions of which they are members. The details of the claim are not being disclosed until they have been submitted to the Engineering and Allied Employees National Federation, but it is reported to be on similar lines to that of the application already made for male employees in the industry.

Goods Entering Palestine

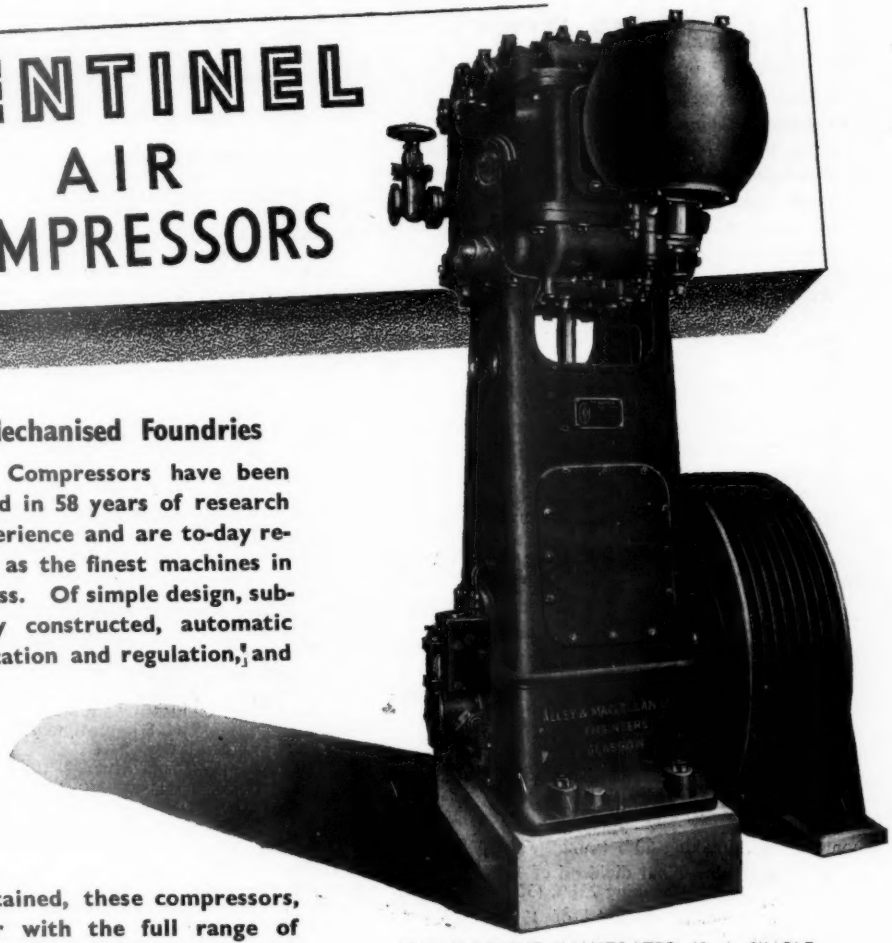
The Palestine authorities have issued new instructions about import licences for goods entering that country. Details will be announced when the full text is available. Meanwhile the Board of Trade brings to the notice of exporters certain points from advance information received. As a result of the removal of Palestine from the sterling area, import licences issued before February 22, 1948, are declared invalid except for that portion of the licence for which confirmed credit has been opened. Goods arriving in Palestine against import licences thus invalidated will only be released from Customs on production of documents showing that shipment was made before March 15, 1948. New applications for licences for goods shipped after this date will be considered only if terms of payment are against letters of credit. It is emphasised that new applications for licences will not be considered where the terms of payment are:—(*a*) Cash against documents; (*b*) cash on delivery; (*c*) on current account.

Imports which have already been received on consignment (including consignments in bond) must be declared before March 22, 1948, to the Controller of Foreign Exchange or transfer of currency will not be considered.

Examination of Controls

Following the recent statement that the Board of Trade and the Ministry of Supply have appointed special examiners to undertake a comprehensive review of the controls they exercise, it is announced that Sir Frederick Bovenschen, who was appointed examiner for the Ministry of Supply, is at present reviewing the controls exercised under certain orders affecting the following trades:—Machinery, plant and appliances (general); electrical appliances; office machinery; turbo-alternators; hand and machine tools, and other trades.

SENTINEL AIR COMPRESSORS



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Company News

(Figures for previous year in brackets.)

Peglers—Dividend of 45% (same).

Lobnitz & Company—Dividend of 8% (same).

C. H. Bailey—Interim dividend of 7½% (same).

Switchgear & Cowans—Dividend of 20% (10%).

Fredk. Sage & Company—Dividend of 6% (same).

Steel & Company—Interim dividend of 7½% (same).

British Ropes—Final dividend of 15%, making 20% (same).

W. H. Dean & Son—Interim dividend of 10% (same).

Beans Industries—Final dividend of 27½%, making 37½% (same).

R.F.D. Company—Final dividend of 6% (same), making 6% (10%).

Brown Bayley's Steel Works—Interim dividend of 4%, tax free (same).

Bruntons (Musselburgh)—Final dividend of 15%, making 20% (same).

Hoffmann Manufacturing Company—Dividend of 7½%, tax free (same).

Valor Company—Dividend of 12½% (7½%) and bonus of 7½% (same).

Coventry Gauge & Tool Company—Dividend of 15%, tax free (same).

Sheffield Forge & Rolling Mills Company—Interim dividend of 5% (same).

Guest Keen Baldwins Iron & Steel Company—Dividend of 10% (same).

British Aluminium Company—Final dividend of 6% (8%), making 10% (same).

Hoods—Final dividend of 10% (same) and bonus of 7½% (5%), making 17½% (15%).

Blythe Colour Works—Final dividend of 30% and bonus of 30%, making 80% (same).

Glover & Main—Final dividend of 10% (same) and bonus of 7½% (15%), making 22½% (30%).

Brown Bros.—Final dividend of 17½% (12½% and tax-free bonus of 3%), making 20% (15%).

Clayton Dewandre Company—Final dividend of 8% (6% and bonus of 2%), making 12% (same).

Lancashire Dynamo & Crypto—Final dividend of 10% and bonus of 7½%, making 22½% (same).

Hammond Lane Foundry Company—Final dividend of 7% and bonus of 2½%, making 12½% (same).

Union Steel Corporation (of South Africa)—Final dividend of 5% and bonus of 2%, making 10% (same).

Tipper Industries—Final dividend of 17½%, making 25%. The company was incorporated in November, 1946.

R. & W. Hawthorn, Leslie & Company—Interim dividend of 5% (same) and bonus of 1%, tax free, out of interest on tax certificates (same).

Gas Purification & Chemical Company—Net profit for 1947, £4,969 (£3,799); dividend of 8% (same); to general reserve, £1,000 (same); forward, £8,659 (£7,220).

North British Locomotive Company—Net profit for 1947, £64,845, after providing £131,000 for taxation and £60,000 to general reserve; dividend of 5% (same); forward, £61,185 (£51,340).

Charles Baynes—Trading profit for 1947, plus other income, £20,589 (£23,292); overprovision of tax in 1946, £1,230 (nil); final dividend of 35%, making 60% (same); forward, £9,245 (£5,386). The company was made public in March, 1947.

Willenhall Motor Radiator Company—Net profit for 1947, £19,926 (£12,303); to future tax, £10,000 (£5,510); general reserve, £5,000 (£2,000); contingencies, nil (£1.00); dividend of 20% (same) and bonus of 10% (5%); forward, £3,568 (£3,141).

Firth-Brown Tools—Profit for 1947, £249,949; to directors' fees, £2,500; depreciation, £39,106; profits tax and income tax, £151,112; balance at credit of profit and loss account, £57,231; dividend of 7½%. The company was made public in December, 1946.

George Edmonds—Net profit for 1947, after tax, etc., £16,323 (£11,762); to pensions, £1,000 (nil); general reserve, £5,000 (£2,500); doubtful debts reserve, nil (£300); capital reserve, nil (£1,470); final dividend of 30%, making 60%, and bonus of 25%; forward, £9,865 (£6,774). The company was made public in March, 1947.

L. Gardner & Sons—Profit for 1947, after taxation and depreciation, £111,545 (£92,279); patent royalties, £2,197 (£782); dividends and interest from subsidiary company, £18,348 (£18,339); sundry investments, £513 (£530); tax certificates, £802 (nil); dividend of 50% (same); general reserve, £100,000 (nil); plant reinstatement reserve, £100,000 (nil); forward, £175,897 (£301,488).

Mather & Platt—Trading profit for 1947, £542,905 (£304,740); to tax, £232,000 (£80,000); depreciation, £83,896 (£60,088); directors' fee, £500 (same); deferred repairs, nil (£14,724); reserve against shares in subsidiary companies, £36,034 (£4,000); net profit, £190,475 (£145,428); to special reserve, £14,394; written off goodwill, £10,000; general reserve, £100,000 (£50,000); employees' benefit fund, £5,000 (same); final dividend of 7%, making 11% (same); forward, £84,769 (£88,401).

General Refractories—Trading profit for 1947 (with subsidiaries), £330,681 (£283,723); income from investments, £995 (£2,262); to interest, £2,374 (£2,395); depreciation, £77,711 (£50,665); E.P.T., nil (£47.245); income tax, £104,965 (£93,354); profits tax, £35,675 (nil); profit attributable to outside interests, £4,723 (£2,921); net profit, £106.228 (£89,405), of which £88,313 (£80,662) is included in the parent company's accounts; to general reserve, £50,000 (£40,000); dividend of 10% (same); forward, £66,892 (£64,329).

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Raw Material Markets

Iron and Steel

The recent expansion of pig-iron production is continuing, but the aggregate output still falls short of current requirements. Coke stocks are reported to be above normal levels, and production of native ironstone is on a better scale. Thus, it may be possible in the not distant future to raise the output of high-phosphorus iron for which there is a clamant demand from the light foundries. Engineering and jobbing foundries also find that hematite, refined, and low- and medium-phosphorus irons are in short supply and applications for additional allocations cannot be entertained.

Deliveries of prime-quality billets, blooms, and slabs from steelworks are substantially increased, but there is still a large unsatisfied demand from the re-rolling industry. Both for the remainder of the current period and also for Period II, re-rollers have an enormous volume of orders in hand and production of sheets is now 82 per cent. in excess of the 1938 figure. Consequently, there is no relaxation of the pressure for all classes of semi-finished steel and even defectives are eagerly sought. Imports from the Continent are so far on a very disappointing scale and, to a greater extent than ever before, the re-rolling plants are dependent on home sources for essential supplies.

Apart from tubes, direct exports of finished-steel products are rather below the corresponding figures for last year. More material is being supplied, however, for the fulfilment of the export targets of various steel-using industries, and home deliveries to non-priority as well as priority users are on a better scale. Nevertheless, there will be extensive cancellations of orders at the end of the month, and the issue of the new I.S. authorisations for Period II is proving a difficult task. Outputs of plates and sections are running at a very high rate and recent deliveries to the shipyards give no cause for complaint.

Non-ferrous Metals

It seems as if the vigorous start in virgin copper usage recorded for January, following a heavy consumption during the last quarter of 1947, has caused the Government to take stock of the supply situation, for there was an intimation last week that a cut of 7 per cent. was to be made in consumption. According to the figures issued by the British Non-ferrous Metals Federation, United Kingdom consumption of virgin copper in January amounted to about 37,000 tons, while a figure of about 36,000 tons was reported for October last, the average of the last quarter being approximately 32,000 tons monthly. At any rate, in formulating its plan for keeping the usage of virgin copper within reasonable bounds, the Ministry has taken the fourth quarter of 1947 as a basis, and it is on average usage during those three months that the cut has been made. The effect will be to bring down the country's monthly consumption of copper to a maximum of 30,000 tons, making 560,000 tons for the year, unless, of course, some adjustment should be made. In zinc, there has been a cut of 20 per cent., but this applies only to galvanising, for there is to be no interference in zinc used for alloy making. It will be remembered that the zinc-oxide industry and the die-casting industry suffered some reduction in their permitted usage many months ago.

Although the Government's decision to cut down consumption of copper and zinc was not made known specifically to the Press, the news travelled quickly, and by the end of the week a sharp advance had been registered in the prices of copper and brass scrap, particularly the former, for, as already mentioned, no reduction is being made in the allocation of zinc to the brass trade. H.C. copper-wire scrap has advanced practically to the peak it touched before, *viz.*, £127-£128 per ton, while 70/30 brass scrap of recognised purity stands at about £105. Nowadays, the scrap barometer is very sensitive and is liable to rise or fall with remarkable rapidity, and it is perhaps as well that this announcement by the Government has come at a time when circumstances indicate that the trend of activity is more downward than upward. Consumer demand for both brass and copper products is still well maintained in the United States.

New Advisory Board for Darwins

Darwins, Limited, high-speed steel manufacturers, etc., of Sheffield, has announced the creation of a new advisory board comprising three workers' representatives and three management representatives, to help direct the policy of the company. The company's finances and profits will be disclosed, and the board will learn everything about the factory and be invited to recommend in what proportion profits should be allocated to new machinery, new means of production, bonuses and rewards to workers. The board will also have power to make recommendations on all matters affecting workers, but will not deal with wages or salaries.

The chairman of the board will be Dr. N. D. Chopra, chairman of the company.

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

John Lysaght's Bristol Works—To acquire from John Lysaght that part of its undertaking which is carried on at Bristol, and to carry on business of constructional, mechanical and agricultural engineers, etc. £1,000. C. Cooper, 18, Austin Friars, London, E.C.2, subscriber.

Crittall-Luxfer Aluminium Windows—To acquire all or part of the business of the Crittall Manufacturing Company, and Luxfer, and to carry on business of manufacturers of metal window frames, etc. £125,000. E. Sanders, 118. Old Broad Street, London, E.C.2, subscriber.